

SPATIAL PHASE LOCKING  
WITH SHAPED ELECTRON BEAM LITHOGRAPHY

ABSTRACT OF THE DISCLOSURE

Fine positioning of a shaped or patterned charged particle beam without use of intrusive fiducial marks is achieved by providing a dithered shadow pattern, preferably in the form of a grid, within the shaped or patterned charged particle beam. Light output from fiducial marks preferably formed of a scintillating material is reduced when the dithered shadow pattern is incident on some or all of the fiducial marks. The timing of the incidence of the shadow pattern on fiducial marks indicates the position of the shaped or patterned charged particle beam such that correction of the beam position on the target can be corrected to a small fraction of system resolution. The dither pattern and repetition period is chosen to avoid interference with uniformity of beam illumination of the target. Feedback of position error thus provides phase locked position correction in real time and is suitable for mask making since the fiducial marks are not intrusive.